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ABSTRACT

This report presents the results of a comparative study of two junior high school science programs, a modular, individualized program The Natural World (TNW) and the more traditional Exploring Science program. Opinionnaires were used to sample grade 7 and 8 students' perceptions of their science course and attitudes toward it at several times during the school year. The study indicated that the students using the TNW program had more positive attitudes toward their science program than the other group of grade 7 students while there appeared to be little difference in attitudes between the two groups of grade 8 students. (Author/MA)

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FINAL REPORT ON THE PILOT OF THE JUNIOR HIGH SCIENCE PROGRAM THE NATURAL WORLD AT VINCENT MASSEY SCHOOL, BRANDON, MANITOBA, CANADA. - JULY, 1977

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ABSTRACT

A comparative study of two junior high science programs, the modular, individualized program The Natural World (TNW) and the more traditional Exploring Science program, using an opinionnaire to sample grade 7 and 8 students' perceptions at several times during the school year. The study indicated that the students using the TNW program had more positive attitudes toward their science program than the other group of grade 7's while there appeared to be little difference in attitudes between the two groups of grade 8 students.

FINAL REPORT ON THE PILOT OF THE JUNIOR HIGH SCIENCE PROGRAM THE NATURAL WORLD AT VINCENT MASSEY SCHOOL, BRANDON, MANITOBA, CANADA - JULY, 1977

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Over the past several years junior high school students and teachers have become increasingly dissatisfied with the content and methodologies of traditional science programs. The Manitoba Department of Education has established a junior high school science curriculum committee to study some of the newer programs and make recommendations regarding changes in the curriculum.

One of the programs under study is the series The Natural World published by Silver Burdett and distributed in Canada by General Learning Company. This is a revision and modular adaptation of the original series Probing The Natural World produced by the Intermediate Science Curriculum Study (ISCS) project.

The Natural World differs considerably from the traditional junior high school programs used in Manitoba. Rather than using the traditional general science approach in which many unrelated topics are treated each year, it provides a flow or sequence of related topics from physics in grade 7 (Level 1), through chemistry in grade 8 (Level 2), to biology, earth science, and space science in grade 9 (Level 3). In addition, The Natural World program makes use of a self-paced, individualized, flexible, activity-centered methodology rather than the teacher-centered, lockstep approach found in most traditional programs.

IMPLEMENTATION OF THE PROGRAM AT VINCENT MASSEY SCHOOL

With the financial support of the Brandon School Division #40 and the Manitoba Department of Education the Level 1 (Gr. 7) and Level 2 (Gr. 8) materials for The Natural World program were introduced into the science program at Vincent Massey School in the fall of 1976. The program was used by all of the grade 7 and 8 science classes during the 1976-77 school year. The five grade 7 classes were not semestered and so studied the Level 1 materials throughout the year. The six grade 8 classes were semestered so that three classes studied the Level 2 materials during the fall semester and the other three classes took the program during the spring semester.

All of the grade 7 classes were taught by Mr. Wrobleski. The three fall-semester grade 8 classes were taught by Mr. Clark while the three spring-semester grade 8 classes were taught by Mr. Brandon. The reason for the change in instructors at the Grade 8 level is that Mr. Clark left the teaching profession at the end of the fall semester to go into cattle ranching.

The Level 3 (Gr. 9) materials will be implemented in September, 1977.

General Comments Regarding Implementation Procedures

The implementation of both Levels 1 and 2 in the same school year did not seem to produce any great problems despite the sequential nature of the course. A few of the Level 2 students ran into minor problems when they encountered unfamiliar words such as "operational definition" or unfamiliar equipment such as the "force-measurer". However, the designers of the program have anticipated most of these problems and provided remedial excursions in which the student is taught the prerequisite skills or knowledge.

The only real problems encountered in implementing the program was in obtaining the necessary equipment promptly from the supplier. GLC is aware of these problems and has given the teachers assurances that the problems are being looked after.

Evaluation Instrument

Since the new program deals with somewhat different subject matter and has different objectives than traditional science programs, it is not possible to directly compare student achievement in the new program and more traditional programs. However, we have used a twenty-item opinionnaire to measure students' attitudes towards their science program and provide some objective, comparative data.

The opinionnaire used in the study is a slight modification of an instrument devised by Fisher* for use with junior high school students. The first 19 items consist of statements about various aspects of a science program. Students epxress their feelings about their science course by indicating whether they strongly agree, agree, disagree, strongly disagree or are undecided about each of the statements. The final item is an open-ended sentence-completion item.

In addition to the opinionnaire several observers were present at various times in the experimental classes and these observers provided anecdotal evidence.

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*Fisher, Thomas H. "The development of an attitude survey for junior high science". School Science and Mathematics V 73 no. 8 (Nov/73) pp. 647-652.

Subjects

Students from the grade 7 and 8 classes using The Natural World program at Vincent Massey School served as the experimental group for this evaluative study. Students from grade 7 and 8 classes from another school in the Brandon School Division served as the control group. The students in the control group were studying the Exploring Science series (Canadian Edition) by Thurber and Kilburn.

The control groups consisted of two intact science classes (7A and 8B). Each member of these classes completed the opinionnaire three times during the course of the school year.

The experimental group consisted of all those students studying The Natural World program. For each administration of the opinionnaire approximately 35 students from each grade level were randomly selected to complete the opinionnaire. At the grade 8 level this was about a 35% sample while at the grade 7 level it was about a 25% sample.

The students in the grade 8 experimental group were on a semester system while the students in the grade 8 control group were non-semestered. The grade 7 students in both the experimental and the control groups were non-semestered.

The study was biased heavily against the experimental program because all of the control group students were from above-average ability classes (7A and 8B) while the experimental group students were chosen randomly from among all of the students taking the new program and represented a wide spectrum of abilities.

Procedure

In order to assess students' initial impressions of their science programs, the opinionnaire was administered to each group of students about one month after they began the course. In the case of non-semestered students and fall semester students, this occurred during the first week of October, 1976. In the case of spring semester students, this occurred during the first week of March, 1977.

In order to assess students' impressions of their science programs after they had more experience with it, the opinionnaire was administered a second time to semestered students (near the end of the semester - the first week of February and the first week of June) and a second and third time to non-semestered students (after 6 months of instruction - the first week of March, and near the end of the year - the first week of June).

In all cases the survey was administered by a person other than the regular classroom teacher. Although the students were instructed to write their names on the response forms, they were assured that their responses would be kept strictly confidential - their teacher would only see a summary of the results.

Results

The students responses to each of the first 19 items were tallied and the responses converted into numerical equivalents as follows: strongly agree = 5, agree = 4, undecided = 3, disagree = 2, strongly disagree = 1. The responses for each item were then averaged for each group. The average responses for the grade 7 groups are shown in Table I while those for the grade 8 groups are shown in Table II. Abstracts of the students' responses to the sentence completion item are given in Tables III to XV inclusive.

Discussion of Results

In considering the students' responses to the first 19 items as summarized in Tables I and II*, the grade 7 students using The Natural World program seemed to have a considerably more positive attitude toward their science program than the control group and the difference is consistent throughout the school year. On the other hand, there seems to be relatively little difference in the attitudes of the grade 8 groups except that the experimental groups consistently judged their program to be more fun in comparison to last year than the control group (item 12). A perusal of the open-ended responses abstracted in Tables III to XV supports these general observations. There are several possible explanations for these differences or lack of differences.

One possible explanation is that the grade 7 level of The Natural World is significantly more interesting for students than the grade 8 level. And, as a result, a difference was detected between the experimental and control groups at the grade 7 level but not at the grade 8 level.

Another possible explanation is based on the fact that it was not possible to use a research design that controlled for the teacher variable. The differences in teaching styles, personalities, and approach may have swamped the program differences. This may well have been the case because at the grade 8 level, where no differences were apparent, the control group teacher was using an activity-based approach, while at the grade 7 level, where differences were apparent, the control group teacher was using a more traditional lecture-notes-taking approach.

A number of students in the experimental groups made negative comments regarding the tests. These are standardized tests using a multiple-choice format and tend to focus on applications and transfer of concepts. Students seemed to react negatively to these tests, especially at the beginning of the year. This may be due to the students' unfamiliarity with the testing format or to the failure of their usual strategy for studying for tests (receive, remember, regurgitate).

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*A typical standard deviation for students' responses is about 1.0 scale units so that a difference of 0.5 or greater between averages of two groups would be a significant difference.

The consistency of students' favorable attitudes toward the experimental program from the beginning of the year to mid-year or from the beginning to the end of the semester indicates that the students are not simply reacting to the novelty of the new program but rather find it interesting and exciting.

Anecdotal reports from teachers and observers support the favorable opinionnaire data relating to the experimental programs. Students would come to class early and leave late, even on Friday afternoons. During the first semester one of the grade 8 classes had two eighty-minute science classes back-to-back in the afternoon on one day every cycle. In this class less than half the students bothered to leave their work during the 10 minutes break between classes and well over 75% of them were still working enthusiastically near the end of the second period after having spent 180 minutes in science class.

Conclusions

The reader is cautioned about drawing definite conclusions regarding the relative merits of The Natural World and traditional science programs on the basis of the results of this study. The fact that each of the experimental group teachers teaches all of the classes at one grade level and teaches no other science courses makes it impossible to devise a research design that does not confound the teacher and program variables.

However, the pilot program at Vincent Massey School does indicate that The Natural World is a viable alternative to more traditional junior high science programs and that it is enthusiastically received by students. Although the program is probably not for everyone, it deserves serious consideration by schools interested in providing their students with an acitivity-centered, individualized flexible science program that permits true continuous progress.

NOTE: The higher the average the more students agree with the statement.

TABLE I

AVERAGE OF STUDENTS' RESPONSES - GRADE 7

STATEMENT	EXPERIMENTAL			CONTROL		
	OCT/76	MAR/77	JUN/77	OCT/76	MAR/77	JUN/77
1. MY SCIENCE TEXT BOOK IS HARD TO READ.	2.2	2.2	2.4	1.9	2.1	2.1
2. WE SPEND TOO MUCH TIME DOING EXPERIMENTS.	1.9	2.1	2.2	1.6	2.4	2.7
3. I AM LEARNING A LOT IN SCIENCE THIS YEAR.	4.1	4.0	3.6	3.7	3.4	3.5
4. I LIKE COMING TO SCIENCE CLASS.	4.1	3.8	3.4	3.6	3.0	2.8
5. I ENJOY DOING THE SCIENCE EXPERIMENTS AND ACTIVITIES IN THIS COURSE.	4.4	4.1	3.7	3.9	3.0	3.2
6. WE DO NOT DO ENOUGH SCIENCE EXPERIMENTS IN CLASS THIS YEAR.	2.6	2.4	2.4	3.4	2.8	2.8
7. I CAN SOLVE SCIENCE PROBLEMS BETTER THAN BEFORE.	3.6	3.9	3.5	3.3	3.3	3.4
8. MOST STUDENTS IN MY CLASS ENJOY DOING SCIENCE EXPERIMENTS.	4.0	3.5	3.2	3.8	3.6	3.0
9. WHAT I AM LEARNING IN SCIENCE HELPS ME UNDERSTAND MORE ABOUT HOW THINGS WORK.	4.0	4.1	3.8	4.0	3.7	3.6
10. I THINK ABOUT THINGS WE LEARN IN SCIENCE CLASS WHEN I'M NOT IN SCHOOL.	3.2	3.2	2.5	3.2	3.2	2.9
11. I DO NOT WANT TO TAKE ANY MORE SCIENCE CLASSES IF THEY ARE LIKE THIS YEAR'S COURSE.	1.8	1.9	2.3	2.4	2.6	3.0
12. SCIENCE IS MORE FUN THAN IT WAS LAST YEAR.	4.1	4.1	4.1	3.2	2.8	2.6
13. SCIENCE IS DULL FOR MOST PEOPLE.	2.6	3.0	3.0	3.0	3.0	3.6
14. THE THINGS WE DO IN THIS CLASS ARE USELESS.	1.7	2.0	2.2	2.1	2.0	2.7
15. I TALK TO MY FRIENDS OR PARENTS ABOUT THE THINGS I LEARN IN SCIENCE CLASS.	3.2	3.4	2.5	3.2	3.1	2.8
16. I WOULD RECOMMEND THIS SCIENCE COURSE TO MY FRIENDS IF THEY WANTED TO KNOW WHICH SCIENCE COURSE TO TAKE.	4.1	3.8	3.2	3.3	2.9	2.5
17. THE KINDS OF EXPERIMENTS I DO IN CLASS ARE IMPORTANT.	3.7	3.7	3.4	3.5	3.5	3.3
18. I LEARN A LOT FROM DOING MY SCIENCE EXPERIMENTS.	3.9	4.0	3.7	3.6	3.8	3.3
19. MOST STUDENTS IN MY CLASS LIKE THIS SCIENCE COURSE.	3.9	3.6	3.3	3.3	3.1	2.6
NUMBER OF STUDENTS	35	41	46	33	35	35

NOTE: The higher average the more students agree with the statement.

TABLE II

AVERAGE OF STUDENTS' RESPONSES - GRADE 8

STATEMENT	EXPERIMENTAL				CONTROL		
	START 1 OCT/76	START 2 MAR/77	END 1 FEB/77	END 2 JUN/77	START OCT/76	MIDDLE MAR/77	END JUN/77
1. MY SCIENCE TEXT BOOK IS HARD TO READ.	2.1	2.0	1.7	2.4	1.9	2.0	2.0
2. WE SPEND TOO MUCH TIME DOING EXPERIMENTS.	2.0	2.1	1.7	2.3	1.4	1.6	1.9
3. I AM LEARNING A LOT IN SCIENCE THIS YEAR.	3.8	3.6	4.1	3.6	3.7	3.9	3.9
4. I LIKE COMING TO SCIENCE CLASS.	3.9	3.9	4.5	3.6	3.9	4.1	4.1
5. I ENJOY DOING THE SCIENCE EXPERIMENTS AND ACTIVITIES IN THIS COURSE.	4.2	4.2	4.6	4.0	4.3	4.5	4.1
6. WE DO NOT DO ENOUGH SCIENCE EXPERIMENTS IN CLASS THIS YEAR.	2.0	2.2	1.7	1.8	3.2	[illegible]	2.8
7. I CAN SOLVE SCIENCE PROBLEMS BETTER THAN BEFORE.	3.3	3.5	3.9	3.6	3.4	3.3	3.4
8. MOST STUDENTS IN MY CLASS ENJOY DOING SCIENCE EXPERIMENTS.	3.7	3.5	3.9	3.3	4.0	3.9	3.9
9. WHAT I AM LEARNING IN SCIENCE HELPS ME UNDERSTAND MORE ABOUT HOW THINGS WORK.	3.8	3.5	4.2	3.8	4.0	4.0	4.0
10. I THINK ABOUT THINGS WE LEARN IN SCIENCE CLASS WHEN I'M NOT IN SCHOOL.	2.9	2.8	3.5	2.3	3.5	3.2	3.6
11. I DO NOT WANT TO TAKE ANY MORE SCIENCE CLASSES IF THEY ARE LIKE THIS YEAR'S COURSE.	1.8	2.0	1.3	2.0	1.6	1.7	2.0
12. SCIENCE IS MORE FUN THAN IT WAS LAST YEAR.	4.2	4.3	4.8	4.2	3.5	3.8	3.5
13. SCIENCE IS DULL FOR MOST PEOPLE.	2.3	2.7	2.1	2.7	2.2	2.2	2.4
14. THE THINGS WE DO IN THIS CLASS ARE USELESS.	2.0	2.1	1.6	2.3	1.5	1.8	2.1
15. I TALK TO MY FRIENDS OR PARENTS ABOUT THE THINGS I LEARN IN SCIENCE CLASS.	3.0	2.8	3.6	2.8	3.8	3.5	3.5
16. I WOULD RECOMMEND THIS SCIENCE COURSE TO MY FRIENDS IF THEY WANTED TO KNOW WHICH SCIENCE COURSE TO TAKE.	3.6	3.8	4.5	3.8	3.7	3.9	3.7
17. THE KINDS OF EXPERIMENTS I DO IN CLASS ARE IMPORTANT.	3.6	3.4	3.7	3.2	3.7	3.8	3.8
18. I LEARN A LOT FROM DOING MY SCIENCE EXPERIMENTS.	3.7	3.6	3.9	3.3	3.9	3.9	3.7
19. MOST STUDENTS IN MY CLASS LIKE THIS SCIENCE COURSE.	3.7	3.6	4.1	3.5	4.0	3.8	3.8
NUMBER OF STUDENTS	34	34	34	33	28	33	29

TABLE III

ABSTRACTS OF OPEN-ENDED RESPONSES

GRADE 7 - Experimental - Start of Year (October/76)

I think science class:

- is sometimes interesting. I enjoy coming to class.
- is very important. I like science very much.
- is fun in a way but sometimes boring.
- is good and will help in years to come.
- is fun.
- is fun to come to.
- is very exciting.
- is very fun and easy.
- is very good because you learn and find out ways things work.
- is sort of easy.
- is fun and I usually learn a lot.
- is fun and educational.
- is lots better than last year.
- is fun in some ways and not too bad in other ways.
- is not bad. It's not boring and sometimes lots of fun.
- is fun and you learn a lot.
- is a well based program and I learn a lot.
- is a lot better than last year - I can understand it.
- is good but I don't like to answer questions in metric.
- is best class that I have ever taken in science.
- is very enjoyable this year with the new program. I hope the years ahead are this rewarding.
- is fun. It's my best subject.
- is very confusing but I never have been a good science student.
- is better than last year.
- is different than any science class I've had - it is more fun and we do more experiments.
- is good and I enjoy the experiments.
- is fun but sometimes the questions don't seem to relate to what we're doing.
- is fun and I enjoy the experiments and questions.
- is really fun and a lot more interesting than in grade 6.
- is lot of fun. We get to do lots of experiments witch (sic) is good.
- is kind of dull - only important if you are planning to be a scientist.
- is interesting and fun - I'm glad I take this course.

TABLE IV ABSTRACTS OF OPEN-ENDED RESPONSES

GRADE 7 - Experimental - Mid Year (March/77)

I think science class:

- should be more difficult and teach the workings of more complex machines.
- is very interesting and educational. It always helps to learn these things even if you don't plan to go into science of any kind.
- is fun, interesting and enjoyable. I would like to do this next year.
- is helpful in many things and can be interesting.
- is a rewarding experience for anyone. It helps you to understand different things. It will also help you in later life.
- is good for someone who likes to do experiments and wants an informative science class.
- is fun and also we learn how to do things. We also get ideas on other problems we have.
- is better than last year.
- is good but some experiments are a bit wierd. (sic)
- is okay but sometimes the experiments and tests are a little confusing and don't have to do with the text.
- is useful to us. It helps us understand how things work and will help us in various occupations when we're older. I plan to be a lab technitian (sic) and this science class will help me a lot. It is fun to do these experiments on our own.
- is better than last year. Some experiments I like and others I don't. I hope I do this next year.
- is better than last year and is easier to learn. Some of the things are boring but others are kind of interesting.
- is very important to me. It is not boring and I like doing these new kind of booklets.
- is fun and easy to work out.
- is sometimes interesting but some of the experiment directions are kind of complicated.
- is very interesting and I enjoy taking science very much. It is my favorite subject and the teacher is very helpful.
- is very good because we have a nice teacher plus we do a lot of experiments and have fun.
- is fun because the experiments are fun to do and you learn how pulleys work and about different chemicals.
- is good for learning and understanding science plus it is fun to do.
- is fun because you can do experiments and learn things from what you do.
- is good in some ways but I hate answering such useless questions.
- is fun and I think I learn a lot from the science books.
- is not bad sometimes.
- is fun at times and can be educational. But I think that most of our experiments are not too useful and I liked last year's program better.
- is fun sometimes. The only time I don't like it is when we have a test.
- is a good way to learn.
- is fun sometimes but other times it's a bore. Otherwise it is a good subject.
- is alright except when we have tests.
- is enjoyable. It has very interesting things. Fun. Sometimes it is BLA!! I really like it
- would be better if the teacher would do the experiment, we would write ip ut, and then hand it in. I think we would learn more this way.
- isn't that bad. But. I hate the tests and making corrections. Some of the experiments are boring.
- is fun and educational at the same time. It is also very interesting. I like it very much.
- is fun this year because I can work with a partner I like to work with. In the course there are experiments that I can prove myself right or wrong. Last year I hated science because I had it drilled into my head. This year I'm having fun too.
- is fun and I learn a lot from it.
- is very important in everyday life.
- is really fun when we do experiments and not too much paper work. I think the tests are really hard and should be worded better.
- is helpful when you don't fool around. The experiments are fun but the tests are hard and confusing.
- is fun and exciting. I think I learned more this year than any other.
- is enjoyable although sometimes it gets too noisy and out of hand.

TABLE V ABSTRACTS OF OPEN-ENDED RESPONSES

GRADE 7 - Experimental - End of Year (June/77)

I think science class:

- should have more interesting experiments. Most of the time I don't understand the questions.
- is alright but is sometimes a bore when the questions about the experiments get too complicated.
- is useless. I can learn things on my own.
- is sometimes very interesting but sometimes it can be very boring.
- is very dull. I don't like the things we do.
- is sometimes boring and sometimes alright.
- is fun because you learn new things.
- is more fun this year than it ever was.
- is one of the best subjects I take because you don't have to write lots of notes.
- is fun and you aren't bore by taking notes. I think I've learned a lot.
- is kind of boring because the tests are hard, you don't remember what you learned, and you don't get enough help.
- is better than last year and I like it more.
- is better than last year. I like the books we are using this year.
- is interesting and I have learned a lot more than last year.
- should not be so crowded and noisy. Some experiments require deep concentration.
- is very good. You can work at your own pace and have no homework.
- is fun and I learned a lot of new things.
- is dull and time wasting. The tests are hardly on the same stuff as the text.
- has helped me understand things better.
- is a good way to learn science. I have learned a lot.
- is a worthwhile experience.
- needs more supervision. The texts should explain better.
- needs more teachers to help you with the questions.
- is not bad but could be better. The tests are not from the text so it doesn't help to study.
- should be as it is but with fewer experiments.
- is important.
- is very important and fun as well.
- is interesting but sometimes I don't like the experiments.
- should have fewer experiments and spend the time learning about science.
- is the best science course I have ever had but the tests are very difficult.
- is fun and educational. The experiments help me a lot.
- is interesting. I used to dread science class but I enjoy it more now. I am starting to understand it better now.
- is not teaching me much but its probably better than anything else.
- is fun because you get to work on your own and don't have to listen to the teacher talk on and on.
- isn't as much fun as last year because I don't really understand it now.
- is the boringest class I can think of.
- is very dull and uninteresting.
- is pretty good. I like the experiments but the tests are too hard.
- is great because you can work on your own and at your own speed.
- is one of the good subjects in this grade. Usually worthwhile coming to class.
- is fun most of the time but boring sometimes. I like the course.
- is more enjoyable this year. I like working on my own. The tests are too hard.
- is fun and interesting.

TABLE VI

ABSTRACTS OF OPEN-ENDED RESPONSES

GRADE 7 - Control - Start of Year (October/76)

I think science class:

- is interesting and fun. I learn a lot of new things.
- is okay but we do way too many notes and assignments.
- is fun and interesting but we do too many notes.
- is good but I don't like writing reports and pages of notes.
- is okay but I wish we could do more experiments.
- is important but sometimes boring.
- is fun and educational. I would like to do more outdoor work.
- is enjoyable but I would like to do more experiments.
- is an important class.
- is okay I guess. More time for writing notes and doing projects would be helpful.
- is better than last year. It's more fun and I enjoy the experiments.
- is very interesting.
- is okay I think.
- is full of reports to be done and a lot of notemaking.
- would be more fun if we got to disect.
- is okay. I like doing the experiments.
- can be enjoyable if you like it.
- is pretty interesting. I would like to do lots of experiments.
- is a very interesting way to learn about the world.
- is quite boring because all we do is read and then make notes of the whole thing.
- is fun sometimes, but not other times.
- would be better if the teacher asked us what we wanted to study.
- is fun when you do experiments.
- is fun considering we do lots of notes and drawings and too many reports at one time.
- is fun, I like doing experiments and going on hikes.
- is very interesting and I hope we do more experiments.
- is useful and fun.
- is a bit too boring, like we do too much notes.
- is lots of fun and I learn a lot of new things.

TABLE VII ABSTRACT OF OPEN-ENDED RESPONSES

GRADE 7 - Control - Mid Year (March/77).

I think science class:

- is fun especially when we do experiments and don't have too much homework.
- is enjoyable and helps me learn.
- would be important only if it contained more interesting things to learn.
- is fun when you know what you are doing and understand it.
- is hard.
- gets boring sometimes. It would be better if there were more experiments and we studied outer space.
- is okay at times but can get boring when I lose interest in it.
- would be more interesting if we had more discussions.
- is an interesting subject but I would like to have discussions and jot down notes instead of doing an experimental write-up after each experiment.
- should have more interesting experiments.
- is all right sometimes except when the teacher is in a bad mood and when we have science tests.
- would be better if we stopped using the text and did things that were happening right now.
- is all right for a person who likes science and knows how to take notes, do experiments, etc., but I do not understand some of the things we do.
- is useless. I don't get anything out of it. Some of my friends don't care for it either. I wish they would take it right out of school education.
- is terrible some of the time.
- is okay, sometimes it is boring but not always. Science is not my favorite subject. I think it is hard. I don't do too well in science either.
- is where you can learn a lot of things. But, I think we shouldn't use the book. We should get a contract and then we could form groups and work on it together.
- should have more research and projects rather than always experiments.
- is better now than first term because now we do less notes and more experiments. We also have more discussions which I like.
- is pretty good. Sometimes we do interesting things.
- could be improved if the teacher would let the class decide on the topic to study.
- is enjoyable and fun when we have discussions and do experiments.
- is not too bad, but since it's straight from the text book its gotten dull.
- is not too bad, but not what I thought it would be.
- could be a lot more fun if we didn't always do experiments.
- is boring sometimes. I wish we could study something that isn't in the book.
- is educational but I would prefer to do more environmental projects.
- is very interesting but the tests are very hard!
- is fun and I like doing experiments but I was hoping that this term we could get out of doors and study plants and animals like we did last year.
- is okay, but sometimes I don't understand some things. Science is not my favorite subject but I still like it in some ways.
- is fun doing the experiments but having the teacher do some doesn make this class as enjoyable.
- is not too bad. It would be better if we didn't have to write up all our experiments.
- would be better if the teacher explained more clearly what should be happening or is happening in the experiment.
- is good but I wish we could go places and look around.

TABLE VIII ABSTRACTS OF OPEN-ENDED RESPONSES

GRADE 7 - Control - End of Year (June/77)

I think science class:

- isn't too interesting. We do too many experiments I don't understand.
- is all-right but some topics are boring.
- is boring. I wish I didn't have to take it any more.
- is sometimes hard to understand.
- is better than last term because we do more experiments and less notes.
- is harder than last year but a lot more fun.
- should have more outside work and camping.
- has been enjoyable and fairly well organized.
- is fun when we study plants and animals but I didn't like studying oxygen and light.
- is boring because we never study anything I or the rest of the class are interested in.
- could be better if we did more up-to-date things.
- should have more experiments.
- would be better if we didn't use the textbook.
- is usually boring. If we studied things we enjoyed, the class wouldn't be so hard to control.
- is boring some of the time. We should do other things besides experiments.
- is fun sometimes and dull other times.
- is fairly good. I was better than last year and I learned quite a bit.
- is dull. There should be more experiments, fewer tests, and more interesting topics.
- should be more interesting and not involve home experiments.
- is useless. I get nothing out of it at all.
- is boring. We rush things too much and write too many notes.
- was kind of dull this year. I would like to study more current science topics.
- is not too bad. Too much repetition of previous years.
- is boring - very boring.
- is not good. I like experiments but we never find out if our conclusions are right.
- is dull because all we do is do experiments and write notes about topics the teacher thinks are interesting.
- is fun if we would do more experiments.
- is boring. It would be better if the class got to select the topics we studied and if we had more discussion and experimenting.
- is boring and dull.

TABLE IX. ABSTRACTS OF OPEN-ENDED RESPONSES

GRADE 8 - Experimental - Start of Term 1 (October/76)

I think science class:

- is a lot better than past years.
- is better than last year.
- is very interesting but hard work.
- is a good way to learn about how things work and react.
- is challenging and certainly not dull.
- is sometimes hard but on the hole (sic) better than any science course I've taken.
- is better than last year, all we would do was write.
- is a more advanced course and more up to grade 8 level. It is worthwhile to come to class.
- is good because you do you're own experimenting but you miss science that deals with non-experimental topics.
- is important for learning how to do things.
- is interesting, useful, and most of all educational.
- is very interesting. You find out for yourself what happens.
- is good. This is the best year in science I have ever had.
- is interesting and more fun than last year.
- is pretty good all round.
- is more interesting than last year.
- is sometimes useful and sometimes very boring.
- is fun and isn't boring.
- is fun but I'm not learning much.
- is fun doing experiments.
- is fun but not as educational as it should be - would like more class discussion.
- isn't that thrilling.
- is fun and you learn a lot.
- is easy and enjoyable and I like it.
- is good. You can work at your own speed.
- is really good. You can work at your own rate.
- is fun and interesting.
- is interesting and more fun than last year.
- is enjoyable. You learn a lot of new things.
- is boring. Last year I learned a lot more.
- is enjoyable.
- is a lot funner (sic) than last year.

TABLE X ABSTRACT OF OPEN-ENDED RESPONSES

GRADE 8 - Experimental - Start of Term 2 (Mar/77)

I think science class:

- is fun and I think we learn more than in the other science course.
- is fun this year. Last year was boring but this is better. Some questions are difficult to understand but not too many.
- is fun. I enjoy doing experiments on my own.
- is OK but I'd like to go on some field trips or do some projects. I like the experiments but I hate doing the questions in the book.
- is fun.
- is worthwhile.
- is good but sometimes I find it difficult to concentrate with the noise.
- is fun but sometimes it gets a little too confusing.
- is fun. You learn a lot but I don't think about school when I'm not at school.
- is fun because you learn more from experiments.
- is fun and more educational than last year.
- is a lot better this year than last year but the teacher is strict.
- is OK but the teacher is boring and strict.
- is sometimes not bad and other times not really helpful. Some experiments are useless.
- isn't doing much for me.
- is better than before because you can work at your own speed.
- is very good and I like it very much.
- is fun especially the experiments but I get mad when doing the questions.
- is very interesting.
- is fun and I like doing the experiments. Many of the experiments are interesting.
- is enjoyable if you are anxious to learn.
- is okay, but some of the tests are too hard.
- is sometimes boring. The tests are way too ha Sometimes I wish there was no such thing as science.
- is sometimes dull and sometimes fun. Some of the questions are useless and others are hard to answer. Most of the tests are very hard
- is better than last year as we learn more and do more experiments. We don't get long lectures or long tests. We learn things that are useful. I like it. The tests are quite hard but we don't have to remember little things.
- is fun but sometimes I don't want to do experiments all the time. Some experiments are fun but I would like more notes and discussions.
- is OK but I think there should be more discussion, notes, and even lectures. I feel a student doesn't learn much by just doing some experiments and answering a few simple questions. It isn't challenging enough.
- is fun and interesting but the tests are hard. It is a lot better than just taking a bunch of notes because you do the experiments.
- is okay but the tests are very hard. They don't seem to have anything to do with what we learned. Most kids are getting lower grades this year.
- is fun way to learn things that are usually not much fun. I do feel we could have a little more "supervision" sometimes though. All in all it is a good way to learn.
- is interesting and I enjoy the experiments we do.
- is more or less an easy period. The books aren't too hard but there is a lot of work to do in them. I enjoy them.
- is fun. The science course is good. The experiments are great, but the tests are too hard for our level. Most kids are really smart and they're flunking not because they're dumb but the tests.
- is interesting and fun. I like doing the experiments because they are fun and they help me understand stuff I didn't understand last year. The tests are very hard.

TABLE XI ABSTRACT OF OPEN-ENDED RESPONSES

GRADE 8 - Experimental - End of Term (February/77)

I think science class:

- is much better than last year because we do each experiment ourselves. Also we are not held back or rushed by the teacher.
- has been very different, yet enjoyable.
- is the most interesting way to find out how things work and it improved my attitude toward life.
- should be continued next year but make the books easier to read.
- is more fun this year than last because it is a better course.
- is OK. Some of the questions are pretty hard.
- is a fun and interesting class to have. I recommend this course.
- is fun to attend. I have learned a lot more new things.
- was hard at the start, but after adjustment it was fun to come to science.
- is better than last year and fun to do.
- is always fun and very interesting. I can understand it better than last year.
- has been more understandable than any other year. I never really liked science until this year.
- could be improved if we all worked on the same book and the teacher taught us the experiment and then went and did the answers.
- is a lot of fun and you can learn a lot. I would recommend this course to my friends and would like to work more on it.
- is quite interesting and a great deal of fun. I have learned a lot this year and hope science class next year will be as interesting.
- is fun this year because we don't just sit around and copy notes from the board. We do the experiments rather than the teacher.
- is fun. While you are learning things you are also having fun.
- is great. I really like working at my own speed. I like the experiments, but think some are irrelevant to what we really need to know.
- is interesting. This year I'm doing better on tests and am learning more.
- is better than it was last year. Then we read the book and accepted what it told us. This year we find out for ourselves.
- is enjoyable and fairly easy to do most of the time.
- is interesting, fun and not the least bit dull. I would recommend this course to my friends.
- is a little boring and can be helpful to you or me in the future.
- is a lot of fun and educational. It is not full of notes and diagrams like grade 7.
- is fun and interesting. I learned a lot this year.
- was the best science class I have ever took (sic).
- is more fun this year than last.
- is fun and you seem to learn more because you like it and can work the way you want.
- is most enjoyable and interesting.
- is one of the best I ever had at school. It hope it continues next year.
- for once in my school days is fun to do. If I was to have any science course this would be it.
- is fun and educational and I enjoy it very much.
- this year was interesting and fun. I learned more about how science works. It was better than reading a text.
- is fun, interesting and much easier.

TABLE XII ABSTRACTS OF OPEN-ENDED RESPONSES

GRADE 8 - Experimental - End of Term 2 (June/77)

I think science class:

- is dumb this year. I liked it better last year.
- is sometimes fun.
- is fun. You understand more when you do the experiment by yourself.
- is fun. I like doing experiments.
- is harder than in past years because we have to do so much on our own.
- is fun and I learn a lot.
- is better than last year.
- should be air conditioned since it gets very hot. Otherwise everything is good.
- is much, much better than last year. It has a challenge to it.
- is a good idea but sometimes I notice a lack of equipment.
- is generally pretty good but the tests aren't good. You don't know what you did wrong.
- is OK.
- is fun and I learned a lot more than last year. The tests are poor.
- could be better if the tests weren't too hard. This is a great course.
- is crummy. I learned more last year with notes and lectures.
- is fun and we learned a lot more than last year. I look forward to science class and consider it fun and important. I hope we take this course next year.
- is very interesting. I enjoy working on my own and I think I learn more. I like it even though my mark this year is much lower than last year.
- is a great course this year - I like it. But, I don't like the multiple-choice tests. We were too pushed doing 6 modules - 5 would have been better.
- is more interesting than last year and I learned more by doing it myself.
- is fun and I learn from the experiments. I strongly recommend this course and hope we continue with it next year.
- is fun. It was better than last year because you get to do experiments by yourself and it is easier to learn.
- is fairly hard but it would be better if didn't spend so much time doing experiments.
- is interesting. Some experiments are useless while others are fun and exciting. I hate doing the same experiment again in a different module.
- is dull and boring because I don't understand it.
- is boring.
- is fun when you do experiments.
- is fun because you experiment on many different things but it can also be boring at times.
- is mostly very interesting. I like doing some of the experiments.

TABLE XIII ABSTRACTS OF OPEN-ENDED RESPONSES

GRADE 8 - Control -- Start of Year (October/76)

I think science class:

- is a fun subject and you learn a lot of interesting things.
- is fun.
- is as exciting as a rock.
- is more interesting than last year. I have learned a lot in a short time.
- is interesting and I can learn new things.
- is interesting.
- is interesting and fun but I wish we could do more experiments.
- is fun and sometimes hard.
- is sometimes okay but other times it seems a bit hard.
- is exciting, interesting, and very understandable.
- is fun.
- is good, but too many labs.
- is informative and educational.
- is a great education and is very important
- is very useful. It helps me understand things more.
- is a lot of fun and I am really enjoying it this year.
- is a lot of fun.
- is a lot of fun and I enjoy the labs and experiments. I feel I am learning a lot.
- is really interesting. The things we do are fun.
- is a lot of fun, but only its the way you make it (sic).
- is very interesting. I'm really enjoying Science this year.
- is fun. I enjoy doing experiments and enjoy coming to class.
- is very interesting.
- is pretty fun (sic). I like doing experiments and going on field trips.
- is not just educational, it is also fun.
- is too much work.
- is fun until we have to do notes.
- is fun and you can get to know about things. It's interesting.

TABLE XIV ABSTRACT OF OPEN-ENDED RESPONSES

GRADE 8 - Control - Mid Year (March/77)

I think science class:

- is fun, especially the experiments. Science class is not boring.
- is fun most of the time. I enjoy the experiments.
- is important because it helps you understand how and why things work.
- is a lot of fun. The teacher is nice to us and always tells jokes.
- is very educational. It helps us learn things we didn't know before.
- is fun and I'm learning some things I didn't know before.
- is useless. I don't know why we have to take science. Not everyone wants to become a scientist.
- is more interesting than any other classes.
- is interesting at some times but also boring at other times.
- is highly educational, fun at most times and I like the way the teacher teaches.
- is interesting. I enjoy doing labs.
- is a good and interesting course.
- is fun. I enjoy doing the experiments very much.
- is fun and educational.
- is fun because you learn a lot from the experiments and doing the notes.
- is very educational. It helps us learn about man, nature and the physical universe.
- is a place where you can have fun while you are learning. It is a lot better to go to science and be able to walk around and do your experiment than sit in a crammed desk in another subject.
- is a lot better since the start of school since I was getting low marks.
- is better this year than it was last year because last year I didn't try in science and this year I'm trying. My marks are getting better.
- is more fun this year. I wish we could do more experiments because I think we learn more this way rather than copying down notes.
- is a very fun class and educational also. I would recommend this to anyone that wants to learn and enjoy it!
- is fun except when the teacher gets mad.
- is OK.
- is educational, fun and you also learn something.
- is fun and we learn a lot of stuff too.
- is a good one because you learn important things and still have fun.
- is all right.
- is better than last year. I have learned a lot more than I expected.
- is interesting and has helpful lab experiments.
- is fun and a lot of hard thinking. The teacher is good and makes it fun. I like science.
- is fun except for certain things (review questions).
- is fun and I enjoy it very much. I like doing the experiments.
- is great place to find out many things you never knew before. For some kids the class is fun. But for me, I'd rather do experiments.

TABLE XV ABSTRACTS OF OPEN-ENDED RESPONSES

GRADE 8 - Control - End of Year (June/77)

I think science class:

- is fun. I enjoy the experiments if they help us know more of the world around us. I always look forward to class.
- is a good, interesting class.
- is interesting. It is a good course and I think I learned a lot this year.
- is great because of the teacher's personality.
- is sometimes interesting but other times its hard and boring.
- is fun, especially the experiments. I wish we could go on a field trip sometimes.
- is more enjoyable now compared to the start of the course. I would like to spend more time outdoors studying nature.
- is an interesting course. It is easy to understand and not at all dull.
- is ok sometimes but I hated certain units.
- is interesting and important. I enjoy it very much and try my best.
- is kind of stupid.
- is enjoyable. The experiments we do are interesting.
- is good to take. You are more aware of things you hadn't known before.
- is interesting if I pay attention.
- is very educating. I really enjoyed science this year - it was better and easier.
- is fun and yet I am learning more than last year when we had to memorize our notes to do well.
- is very interesting and I like the way the teacher teaches.
- is where you do interesting things.
- is an important subject for knowledge.
- is not as boring as math but I think it isn't necessary.
- is interesting and we learn quite a lot. I enjoy the experiments.
- is fun. You can learn a lot if you try.
- is a class that helps you understand more things. It is interesting and fun.
- is fun sometimes when the teacher is not mad.
- is a lot of fun. I like the teacher a lot.
- is good.
- should be shorter by doing experiments, then notes, then diagrams, then a little discussion on what we just did.